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that these members of the board have resigned and that Mrs. Young may accept the election.

DR. LIVINGSTON FARRAND, professor of anthropology in Columbia University, has been elected president of the University of Colorado.

PRESIDENT THOMAS F. KANE, of the University of Washington, was removed from office on December 12 by the board of regents, who unanimously adopted a resolution declaring the office vacant. The action was the climax of an agitation that has lasted three years, in which a majority of the faculty and students are said to have aligned themselves against President Kane.

AMONG new appointments at the University of Montana are: N. J. Lennes, Ph.D. (Chicago), instructor in Columbia University for the past three years, to be head of the department of mathematics, and A. George Heilman, M.D. (Pennsylvania), to be instructor in biology and physiology.

DR. W. T. GORDON has been appointed lecturer and head of the geological department at King's College, London, in succession to Dr. T. F. Sibly, appointed professor of geology at the University of South Wales, Cardiff.

DR. G. OWEN, lecturer in physics at Liverpool University, has been appointed professor of physics at Auckland University College, New Zealand.

#### DISCUSSION AND CORRESPONDENCE

##### MORE PALEOLITHIC ART

By degrees paleolithic stations are being rediscovered. The large rock shelter of La Colombière, valley of the Ain, some thirty miles southwest of Geneva, is an example. Known since 1875 it had been only superficially explored. The important discoveries of Dr. Lucien Mayet, of the University of Lyons, and M. Jean Pissot, of Poncin, date from October, 1913; and were first announced through the Paris Academy of Sciences on October 20. The trench they dug revealed in section: (1) neolithic at the top; (2) a Magdalenian horizon, the upper section of which with the neolithic had been disturbed by earlier in-

vestigators; (3) a layer of fine sand with débris from the overhanging rock, one meter thick, in which no relics were found, representing a long period of non-habitation by man; (4) Aurignacian layer with fossil remains of the mammoth, woolly rhinoceros, reindeer and horse. Here also was a workshop left by Aurignacian man, flint tools and rare engravings characteristic of the epoch.

The principal find is a large fragment of mammoth bone on which are engraved human figures; a head and upper part of the body including an out-stretched arm and hand; likewise a figure with head and feet missing, probably a female. Both these engravings are in profile, the view easiest to master by a primitive artist working in outline. Fairly good examples of the human form in the round and in relief dating back to the Aurignacian epoch are already known. Engraved figures are rare and so far as the head is concerned are little more than caricatures. The example from La Colombière is no exception in this respect and curiously enough resembles certain engraved human heads previously reported, one from the cavern of Font-de-Gaume (Dordogne), one from the Grotte des Fées (Gironde), and others from Les Combarelles (Dordogne) and Marsoulas (Haute-Garonne). In the Aurignacian layer were also found pebbles with engraved figures of the bison, *Felis*, horse, and wild sheep. When it is recalled that four fifths of all Quaternary engravings are animal figures, the bison and horse predominating, the importance of these two human figures from La Colombière at once becomes evident.

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##### ON INTERFERENCE COLORS IN CLOUDS

THE writer has, for some time, noticed certain colors in clouds as they pass near the sun, and more careful observation indicates that an interesting effect is present which may not hitherto have been described. If the clouds within an angle of  $15^{\circ}$ , or so, from the sun are examined carefully, the sun, itself, being hidden by the corner of a

building or the roof of a piazza, certain parts of thin clouds, or edges of thick clouds, will usually be seen tinged with red or green, the colors often appearing together with red predominating. Occasionally the tint will be straw-color or purple. The effect may be seen at any time during the day, preferably when the sun is at a considerable elevation above the horizon. The colors are seldom intense, but are, nevertheless, very beautiful. They may be distinguished, when faint, by comparing them with any white cloud at an angle of  $30^{\circ}$  or  $40^{\circ}$  from the sun.

As the clouds in question are very brilliant, one's eyes have to become accustomed to the glare before the colors can be seen. Hence it is better to use smoked glass or dark glasses.<sup>1</sup> A smoked glass plate, on which the density of the smoke deposit varies from one edge to the other, is very convenient, as the best density for any particular cloud may quickly be found.

The following facts indicate that the mechanism of the effect is totally different from that by which the rainbow is produced. The colors appear in irregular patches of various sizes, and not in arcs of circles concentric with the sun. In fact, two small clouds may be close together, one being colored while the other is pure white. The red and green do not always appear together, the red occurring alone more frequently than the green. The same portion of cloud will frequently change from one color to the other.

It seems most reasonable to attribute these colors to interference. To make this clear, consider what must happen when white light passes through a water drop or ice crystal. At the surface where the light emerges, the ray will be divided, part passing through, and part being reflected back, to be reflected from the upper, or incident, surface of the drop, thence passing out through the lower surface. This second part will afford interference with the part of the ray that passed through un-

<sup>1</sup> A solution of a substance, having transmission bands in the red and green only, would be best for observing the colors most frequently seen, namely, red and green.

reflected, for a certain wave-length, provided a sufficient difference of phase, between the two parts of the ray, has been introduced. Owing to the shape of the drop, or particle, only one particular ray will, after undergoing this division, have both these parts sent in the direction of an observer on the ground (just as in the rainbow, each drop behaves like a prism, to an observer, but only for light that passes through one particular plane). If, further, we suppose that there are many drops of very closely the same diameter, then an observer should see light of the same color as that transmitted through a thin film, e. g., a soap film or thin mica, of a thickness equal to this diameter.

Certain evidence supports the above explanation. The phenomenon is especially prominent in clouds that are increasing or decreasing in density. For example, in one particular cloud that was observed, which was increasing in size, the edge was first red, then green, then gray. Further, a cloud was occasionally seen with the red and green arranged in three or four alternate bands, strikingly suggestive of Newton's rings, or the fringes produced by an interferometer.

If the explanation here given is correct, these colors, besides of interest as being possibly the only sky colors produced by interference, may also be of some meteorological importance, namely; in giving an idea of the degree of homogeneity of size of drops in portions of thin clouds, by the intensity of the color; of the extent of these portions, by the area occupied by the color, and of the size of the drops, by the particular color present. Perhaps more information could be obtained by a spectroscopic method, whereby the spectrum of a small portion of cloud would show dark bands, corresponding to the wavelengths removed from the light by interference.

ROBERT H. GODDARD

WORCESTER, MASS.,  
November 2, 1913

#### ORIGIN OF MUTATIONS

GATES, in a personal letter, has kindly called my attention to a misstatement contained in